



Docket No: 20239/0204681-US0

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Kazuhiro Hirose et al.

Application No.: 10/599,003

Confirmation No.: 3079

Filed: September 18, 2006

Art Unit: 1793

For: SOFT MAGNETIC MATERIAL AND
POWDER MAGNETIC CORE

Examiner: M. E. Hoban

DECLARATION OF TORU MAEDA PURSUANT TO 37 C.F.R. §1.132

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I, Toru Maeda, declare as follows:

1. I am a citizen of Japan (JP) and over 21 years of age.
2. I was awarded a PhD from the Tohoku University in 2003. From 2003 to the present I have been employed by Sumitomo Electric Industries, Ltd. of Osaka, Japan as researcher. My responsibilities include research of soft magnetic materials. I have extensive experience in the field of materials science. I have particular expertise in the field of powder magnetic materials. My qualifications are explained in greater detail in the attached copy of my Curriculum Vitae (Exhibit A).
3. Prior to the time of filing of the Japanese Patent Applications from which the above-referenced patent application claims priority (Japanese Patent Application Nos. 10-2004-103687 and 2004-103686, each filed on March 31, 2004), the other co-inventors of the present application and I performed experiments to develop a soft magnetic material that would provide

desired magnetic characteristics (for example, low iron losses) after compacting for forming a magnetic core.

4. During the course of our study, my co-inventors and I found that a plurality of composite magnetic particles formed from metal magnetic particles having an insulative coating could be more effectively compacted with the addition of a constrained amount of lubricating powder. More specifically, through significant experimentation described in the specification of our application, we discovered that, when the lubricating powder was formed as fine particles having a mean particle diameter of no more than 2.0 microns and added at a proportion of at least 0.001 percent by mass and no more than 0.01 percent by mass relative to the composite magnetic particles, a compacted magnetic core could be formed having an iron loss less than 200 W/kg. If the lubricating powder was provided in a greater or lesser amount, as shown in Table 1 of our specification, iron loss unexpectedly increased. At page 30, line 9 through page 31, line 7 of the specification for our patent application, we provided the following theories to explain this performance:

If the amount of the zinc stearate used as lubricating powder added is too small, the advantage provided by the addition of the zinc stearate will be inadequate, leading to the destruction of the phosphate coating serving as the insulative coating 20 during compacting. Also, flowability between particles is reduced, leading to increased distortion being introduced into the iron particles during compacting. It is believed that eddy current loss and hysteresis loss increase for these reasons, leading to increased iron loss. If the amount of zinc stearate added is too high, there is an increased amount of the non-magnetic layer between iron particles. This is believed to generate demagnetizing fields between iron particles, leading to increased iron loss.

Also, if the particle size of the zinc stearate is small, the zinc stearate can be distributed uniformly and thinly on the surface of the iron particles, maximizing the lubrication effect. If the particle size of the zinc stearate is large, the probability of its presence between iron particles is less even if the amount added is the same. Thus, the lubrication effect obtained during compacting is reduced. Thus, in this example, powder magnetic core iron loss appears to be reduced when the mean particle diameter zinc stearate is no more than 2.0 microns.

5. I have reviewed in particular the three references cited by the Examiner in the Office Action of July 22, 2009: U.S. Patent No. 6,372,348 to Hanejko et al. ("Hanejko"), U.S. Patent

No. 6,162,836 to Kato ("Kato"), and U.S. Patent No. 5,306,524 to Rutz et al. ("Rutz"). I find that these references fail to teach or suggest a soft magnetic material according to our invention that includes plurality of composite magnetic particles having an insulative coating containing a metallic salt phosphate, and a lubricant formed as fine particles that must be added in a proportion of at least 0.001 percent by mass and no more than 0.01 percent by mass relative to the plurality of composite magnetic particles in order to achieve a level of iron loss after compaction that does not exceed 200 W/kg.

6. Further, it is my opinion that one skilled in the art at the time of our invention would not have derived our invention in view of these references as the result of simple or routine optimization. In my opinion, prior to our study, it would not have been readily understood by one skilled in the art at that time that only a very narrow range of amounts of lubricant as a proportion of the mass of the composite whole would be effective improving the level of iron loss during compaction. For example, Hanejko teaches that a lubricant may be added in amounts as large as 1.0 percent by mass relative to the particles, which in amount is 100 times greater than the upper limit of our range. Moreover, Hanejko suggests that it is equally acceptable to apply the lubricant to the wall of the compacting mold as mixing the lubricant with the particles. With the disclosure of Hanejko as evidence, it is my belief that the above-described theories with regard to the operation of the lubricants that my colleagues and I developed as a result of our experimentation were not known at the time of our invention.

9. In summary, based on my review of the above-cited references, it is my opinion that one skilled in the art at the time of the present invention would not have arrived at our invention based upon the above-cited prior art references cited references and further routine experimentation.

10. I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements are made with knowledge that willful false statements and the like so made are

punishable by fine or imprisonment or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the instant application or any patent issued thereupon.

October 22, 2009
DATED

Tora Maeda